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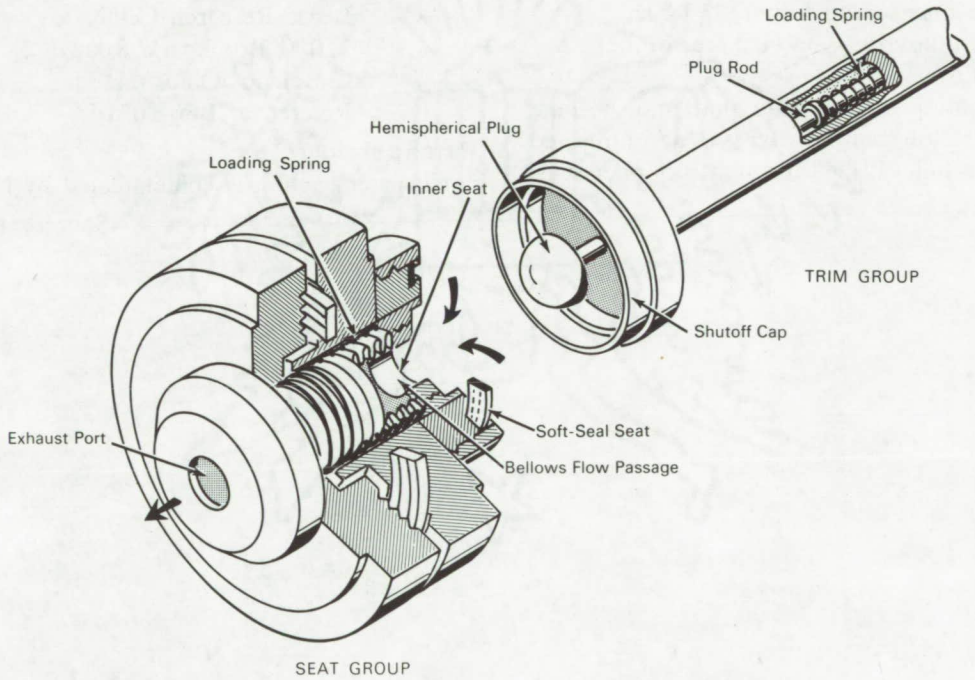
NASA TECH BRIEF

Soft-Seal Valve Holds Hazardous Fluids Safely



The problem:

In transferring hazardous or reactive fluids such as liquid fluorine, much difficulty has been encountered due to the corrosive effects on the valve face and seat material.

The solution:

A valve assembly consisting of a plug to block bulk flow and a soft-seal outer seat to effect zero-leak stoppage.

How it's done:

The valve is made up of a trim group and a seat group. The trim group consists of a hemispherical plug, a loading spring that engages the plug rod, and a stainless steel shutoff cap that is circular in form with a relatively sharp edge. The seat group consists of an inner stainless steel seat that opens into a bellows flow passage and receives the hemispherical plug, plus a soft-seal circular seat that receives the stainless steel shutoff cap.

(continued overleaf)

In operation, fluid flow is directed past the trim group through the stainless steel seat and bellows flow passage and seat group exhaust port. As the trim group is moved forward, the spring-loaded hemispherical plug contacts the stainless steel seat and shuts off the bulk of the fluid flow. Continued forward movement of the trim group brings the stainless steel shutoff cap into contact with the soft-seal circular seat, completely closing the valve. Fluid trapped between the shutoff cap and hemispherical plug gradually gasifies and vents to the downstream side of the valve assembly through the rough seal formed between the plug and stainless steel seat.

The initial seal (which allows downstream venting) is accomplished by:

1. having the inner seat spring loaded
2. designing the annular surface area of the inner seat such that it is larger than the cross-sectional area of the bellows flow passage.

Downstream venting of any fluid that may become trapped in the bellows spring cavity is accomplished through the vent holes drilled through the inner seat.

Notes:

1. Several soft seal materials have been tested successfully. These consisted of tetrafluoroethylene combined with various metal fillers and with a glass filler.
2. This device has been tested and found acceptable up to liquid fluorine flow rates of 2 pps at inlet pressures to 97 psi absolute.
3. Further information concerning this innovation is presented in NASA TN D-1727, "Experimental Evaluation of Liquid-Fluorine System Components" by Richard L. DeWitt and Harold W. Schmidt, June 1963, available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia, 22151. Inquiries may also be directed to:

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   Lewis Research Center
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   Cleveland, Ohio, 44135
   Reference: B66-10216

Patent status:

No patent action is contemplated by NASA.

Source: (Lewis-275)